FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION
DIVISION EIGHT
HIGHWAY PLANNING SURVEY

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ECONOMIC AND TRAFFIC ANALYSIS AND DESIGN REQUIREMENT REPORT ON SWAN RIVER FOREST HIGHWAY ROUTE NO. 15

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FLATHEAD & LOLO NATIONAL FORESTS
LAKE & MISSOULA COUNTIES
STATE OF MONTANA

May 1946

FOREST DEVELOPMENT AND TIMBER HAUL ROADS
CHECK LIST DATA TO DETERMINE STANDARDS
SWAN RIVER HIGHWAY NO.15 (MONTANA)

1. Volume and kind of timber stands.

a. TOTAL VOLUME OF ALL SPECIES BY ALL OWNERSHIPS

	Sawlogs (MBM)	Other Forest Products(MBM)	Total (MBM)
Timber from Swan River -Clearwater River Divide to South end F.H.#15 (near South end of Seeley Lake)	306,000	94,000	400,000
Timber from South end of F.H. #15 to Jct. State Highway #20	162,000	50,000	212,000
Total volumes served by road	468,000	144,000	612,000

b. Kind of timber stand: Sawlogs, pulpwood, poles and ties.

2. Value of timber - $26.00 per M before manufacture and at the mill.

3. Location - Upper drainage of Clearwater River.

4. Existing road deficiency - Narrow and crooked dirt road. Slow speeds necessary on existing road.

5. Expected annual rate of production.	Max. (MBM)	Min. (MBM)	Average (MBM)
A. Area from Swan River - Clearwater River to South end F.H. #15 (near south end of Seeley Lake).	20,000	8,000	10,000
B. Area from South end F.H. #15 to Jct. State Highway #20.	10,000	4,000	5,000
Total from entire area	30,000	12,000	15,000

6. Expected daily rate of production F.B.M. NUMBER OF LOADS	Daily Rate F.B.M.	Truck Loads Per Day
A. From area, Swan River - Clearwater River Divide to South End of F.H. #16	70,000	10 - 15
B. From South End of F.H. #16 to Jct. with State Highway #20	35,000	6 - 8
Total from area	105,000	16 - 23

7. Length of logs to be hauled - 32 to 40 foot sawlogs, poles 35 to 80 feet long.

8. Type of log hauling truck size, i.e., off highway or on highway.
Off highway trucks 10' bunks. Certain products like ties on smaller 8' bunks.

9. Total cost per V.M. and Per MBM.

10. Possible period of haul - 8 months

11. Elevation of road and timber - 4100 to 6000.

12. Precipitation - snow depth - Average 16" in lower country to 36" on divide.

13. Snow removal - Yes, county now removes snow.

14. To be maintained by whom - County or State.

15. Grades and curvature of approach roads and conditions - Only a small number of approach roads are now existing. Plans for the development of utilization and all purpose roads serving as laterals to this highway, contemplates their construction to standards as follows. Width - 12 foot minimum; grades not to exceed 8% with the load, 5% against the load; curvature 80' minimum.

16. Administrative and fire protection travel.

	Estimated Future Annual (Vehicles)
A. Adm. & Fire protection travel.	
From Swan-Clearwater River Divide to South End F.H.#15	1,200
From South End F.H. #15 to State Hwy. #20	1,500
B. Commercial, thru and farming travel.	
From Swan-Clearwater River Divide to South End F.H.#15	12,000
From South End F.H. #15 to State Hwy. #20	15,000

17. Recreational travel.

	Estimated Future Annual (Vehicles)
From Swan-Clearwater River Divide to South End F.H. #15	10,000
From South End F.H. #15 to State Hwy. #20	15,000

18. Estimated Average daily traffic. (See note)

From Swan-Clearwater River Divide to South End of F.H. #15) $\frac{23,200}{365}$ = 64 future avg. ann'l. daily traffic.

From South End of F.H. #15 to State Highway #20) $\frac{31,500}{365}$ = 86 " " " " "

(The above estimates of future daily traffic do not include the daily traffic resulting from the hauling of timber, the traffic created by the loggers traveling to and from work, or the traffic created in hauling supplies, etc., to the logging operations.

19. Road bed width:- two lane overwidth, single lane - The existing road is too narrow to be called a double lane road. See No. 4.

20. Radius (Curvature - widening dependent on log length) - The topography along the route should not restrict the use of good alignment and relatively easy curves.

21. Superelevation.

22. Grades: Adverse, favorable, pitch. From the summit to the junction the haul is on favorable grades. Any adverse grades would be for relatively short distances and on easy grade.

23. Compensation for curvature on ruling grade section.

24. Structure width - 26' between curbs.

25. Structure loading - 50 tons.

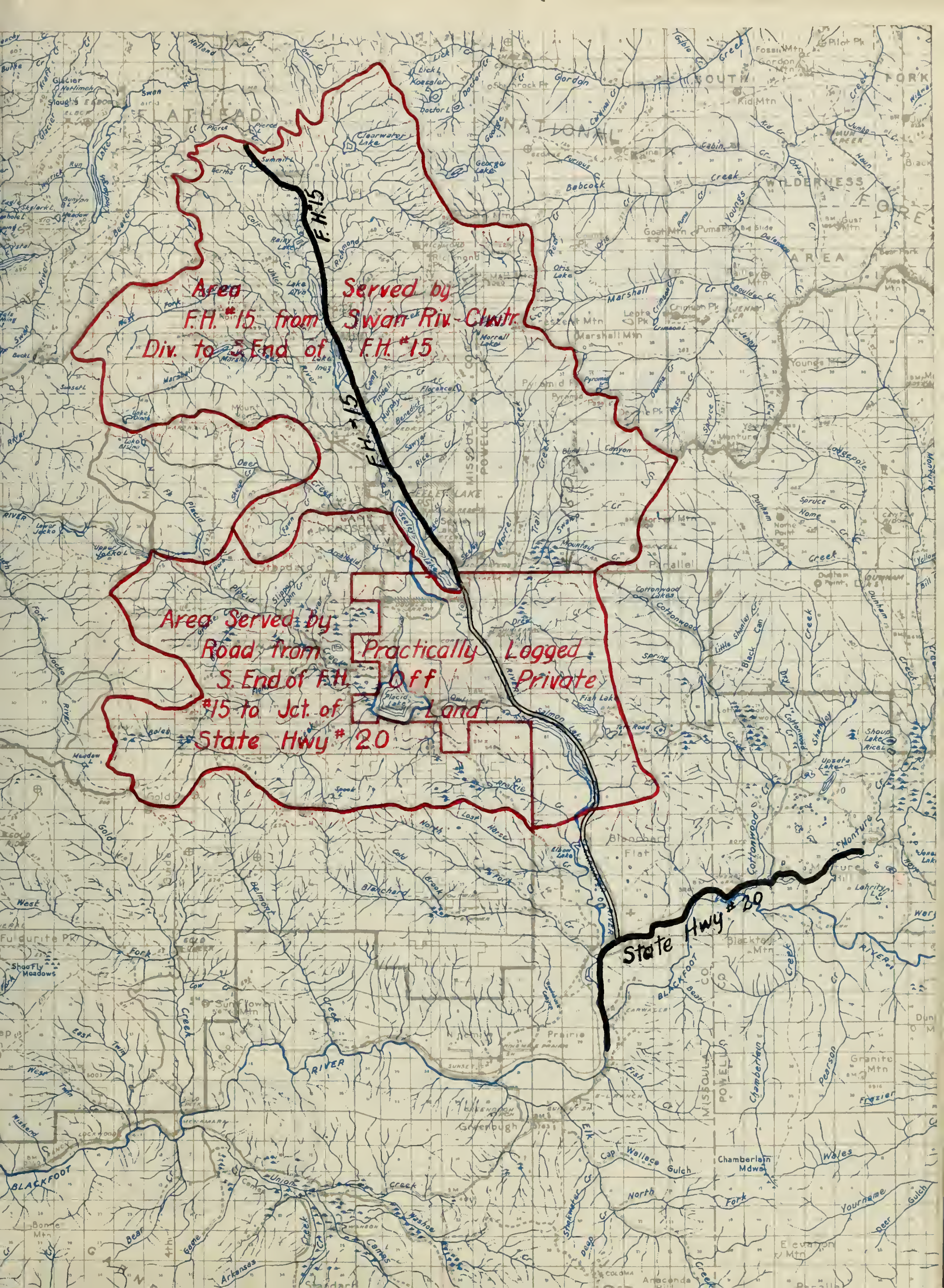
26. Subgrade, sub-base, surfacing, oil - To be oiled.

27. Culvert materials.

28. Bridges.

29. Military Value.

30. Summary and recommendations. The route runs through an area having high recreation use.


Area Served by F.H. #15 from Swan Riv.-Clwtr. Div. to S. End of F.H. #15
F.H. #15
Area Served by Road from S. End of F.H. #15 to Jct. of State Hwy # 20
Practically Logged Off Private Land
State Hwy # 20

FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION
~~DISTRICT ONE~~
DIVISION 8

MONTANA
OREGON
WASHINGTON

POST OFFICE BUILDING
PORTLAND, OREGON

FOR INFORMATION OR INITIALS
MARTIN
CARLEN
FOLK
[illegible]
BY

Helena, Montana
May 9, 1946

To: Mr. L. F. Martin, District Engineer

From: J. F. English, Highway Engineer

Montana Highway Planning Survey

Enclosed is a copy of the Highway Planning Survey Economic and Traffic Analysis and Design Requirement Report on Montana Forest Highway No. 15 (Swan River Highway). All the revisions suggested by the Portland Office have been incorporated in the report and five copies are being forwarded directly to that office.

April 1, 1946

TO: Mr. L. F. Martin, District Engineer
Attention: Mr. J. F. English, Highway Engineer.

FROM: W. H. Lynch, Division Engineer.

Your memorandum of March 6, 1946 requested a review of the economic analysis of the Swan River Forest Highway Montana Route No. 15.

Many of the comments noted in our memorandum of March 18 regarding a similar analysis on the Lewis & Clark Highway will apply to this report as well. In addition it is believed that this analysis should be expanded to include a more detailed discussion of the logging plans to the south end, and of the standards of the approach sections on FAS 361 and FA 24. A discussion of the State's plans for concurrent improvement of substandard approach sections should also be included as suggested in our memorandum of January 9, 1946.

Your memorandum of January 14 indicated that FAS Route 361 had been given first priority for construction. This improvement is not included in the First Postwar Year FAS Program, however.

The fact that this route rates number 26 according to the composite priority formula would indicate that programming at this time might have been premature. This route has been on the Montana Forest Highway System for many years and in spite of good recreational possibilities programming has not previously been proposed. The key point is therefore apparently the necessity for making the area accessible to release logs to maintain production at existing mills. It would appear that this key point should then be stressed in the economic report together with a recommendation for future priority of programming. Our impression is that programming should not proceed except in relation to the needs of the lumber mills at each end. On this basis it is possible that completion of the entire route might be indefinitely delayed.

It is noted on Page 8 that an attempt is made to justify the use of a more or less constant design in relation

April 1, 1960

Mr. L. F. Martin 4-1-46

to traffic. In spite of the low divide and other factors mentioned most existing traffic records show a marked decrease in traffic on such routes ap roximately in proportion to the distance that any point is located from population centers.

We consider this low traffic route to be of borderline importance from the standpoint of construction of its entire length, particularly after reviewing the needs on the other 25 Forest Highway routes which carry a higher priority. The tone of the report does not emphasize this feature sufficiently we believe.

The copy of the analysis is returned herewith containing some additional pencil entry suggestions. If the report is revised substantially in accordance with the above discussion it may be considered as having the approval of this office.

Attach.

CC: FOREST HIGHWAY
ENGLISH

APR - 3 1946

FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION
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ECONOMIC AND TRAFFIC ANALYSIS AND DESIGN REQUIREMENT REPORT ON SWAN RIVER FOREST HIGHWAY ROUTE NO. 15

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FLATHEAD & LOLO NATIONAL FORESTS
LAKE & MISSOULA COUNTIES
STATE OF MONTANA

May 1946

By: J. F. English

J. F. ENGLISH
District Programming
and Planning Engineer

Approved By:

JOHN R. SARGENT
Division Programming
and Planning Engineer

GENERAL

Montana Forest Highway Route No. 15, (class 2), extends from the forest boundary north of Swan Lake to the forest boundary south of Seeley Lake, in Lake and Missoula counties, a distance of approximately 69 miles (designated length 60 miles). From the north, or Swan Lake end, Federal-aid Secondary Route No. 209 extends to the town of Bigfork where a connection is made with Federal-aid Secondary Route No. 210, which in turn connects with Federal-aid Route No. 1 (U.S. #2) 8 miles east of Kalispell. The southern, or Seeley Lake, end of the route joins Federal-aid Secondary Route No. 361, which connects with Federal-aid Route No. 24, (State Route 20) about 41 miles east of Missoula. Thus the route becomes a section of a through connection between Federal-aid Routes No. 1 and 24.

The highway if constructed will be of importance to four types of traffic; that is, Forest Administration, recreational, logging, and general. The area traversed has exceptional recreational possibilities due to the many lakes which will be reached and to the proximity of the highway to Missoula. At the present time, even without the advantages of an improved road, there are many recreational facilities and establishments throughout the area and there is considerable tourist traffic in the summer from all of the surrounding cities; Missoula, Anaconda, Butte, Helena, Great Falls, and Kalispell and from other points in the State. In addition, there are several expensive recreational or summer homes owned by residents of states as far away as New York.

The area traversed is medium to heavily timbered and extensive logging operations are expected to be undertaken as soon as the first section of the road is completed. From a forest administration standpoint the road becomes of importance due to the fact that it is the only through road serving the Swan River and Clearwater River valleys.

If reference is made to the attached key map a comprehensive picture may be obtained of the location and relative importance of the road to the surrounding communities and territory.

This report will not necessarily attempt to justify construction of the highway from a financial standpoint as few roads in sparsely populated states, even on the Primary System, are self-supporting, anymore than are many other public improvements and facilities. That is, traffic over this entire route is expected to be considerably less than that required to construct and maintain it. However, a very high percentage of all highway mileage in Montana has to be partially constructed and maintained by general taxes or by Federal-aid, which is but another form of general taxes. Consequently, this report will be concerned primarily in determining standards on which the highway should be constructed and with the priority of programming.

SYSTEMS

The route is not on any other Federal or State System, except that Federal-aid Secondary Routes overlap both ends for a short distance.

ROUTE DESCRIPTION AND STATUS OF IMPROVEMENT

Federal-aid Secondary Route No. 209 begins at the town of Bigfork, which is on the East Shore of the Flathead Lake Highway (Federal-aid Secondary Route No. 210). From Bigfork the route extends southeasterly approximately ten miles to the Lolo National Forest Boundary and the beginning of Forest Highway Route No. 15. From this point the two routes are coincident for eight miles where the Secondary Route terminates at a point approximately one mile south of the settlement of Swan Lake. The Forest Highway continues southerly up the Swan River Valley approximately 45 miles to the divide between the headwaters of the Swan and Clearwater Rivers, thence it follows down the

Clearwater River 16 miles to its terminus at the boundary of the Flathead National Forest approximately 2 miles south of the settlement of Seeley Lake. For the last four miles of the route it is coincident with Federal-aid Secondary Route No. 361 which extends on down the Clearwater River 15 miles further to a junction with Federal-aid Route No. 24. This Federal-aid Route, with the exception of the first 8 miles, (which is programmed for 1946 construction), has been constructed and paved westerly to a connection with U.S. #10 seven miles east of Missoula; but easterly for about 40 miles there has been no construction to present day standards, although completion of the entire route in the near future is contemplated.

None of the mileage from Bigfork to the Junction with Federal-aid Route No. 24 has been constructed to standard. Part of the Federal-aid Secondary mileage has been improved to a low standard by the counties and a small amount of work has been done by the Forest Service and the counties on Route 15, but the entire Forest Highway section can be classified as unimproved.

No definite plans have been made by the State or Counties for construction of Federal-aid Secondary Route No. 209 in the near future but Route No. 361 has been programmed for improvement sometime during the next three years, having first priority on the 1947 program. This latter route is to be constructed to an overall width of 26 or 28 feet -- 50-P-40 category. Federal-aid Route No. 24 is also being constructed to the same minimum standards.

Grades are exceptionally light and there is no perceptible summit between the two drainage areas involved, the divide being so flat that it is hardly noticeable. The following elevations are indicative of the grades that can be obtained when construction is undertaken:

	Elevation	Distance Miles
Bigfork.....	2,968	0
Beginning of Forest Highway #15..	3,122	10
Swan Lake.....	3,093	17
Summit.....	4,203	63
Seeley Lake.....	4,045	77
End of Forest Highway #15.....	4,022	79
Junction Federal-aid No. 24.....	3,835	94
Junction U. S. #10.....	3,302	128
Missoula.....	3,210	135
Bigfork.....	2,968	235

TIMBER RESOURCES

The Forest Service estimates that a volume of approximately 1½ billion feet of timber is tributary to this route. The timber extends for the entire length of the route and covers an area of approximately 730 square miles, (exclusive of the area tributary to the Federal-aid Secondary Routes). The width involved ranges from 3 to 8 miles on each side of the highway, total average width being approximately nine miles. It is probable that about half of this volume will be hauled to Bigfork and half to the Bonner Mills near Missoula. The distance from the summit is approximately 63 miles in both cases but the exact dividing line for determining length of haul is not known at this time.

The timber lies between elevations 3,000 and 6,000 feet and while snow fall is moderate -- 16 to 36 inches -- the working season is estimated at only 8 months (200 working days) due to the fact that for hauls as long

as those involved, transportation and operating costs are considerably less when the roads are dry and free from snow than during the winter months. Maintenance will be by State or counties.

On account of the primitive condition of the present road heavy loads cannot be transported over it. Consequently, no great amount of timber can be sold until at least a portion of the road is improved. Furthermore, in order to harvest the timber on a continuous yield basis, and on the scale contemplated, it will be necessary to have the entire route completed. In the meantime harvesting will follow construction with production increasing as the highway is improved. Production per square mile opened up will, of course, be greater at first than it will be later on a continuous yield basis, due to the large amount of over-age timber that can be cut immediately on completion of any section of the road.

Anticipating completion of the first few miles of the southern end of the route, the Forest Service has plans for selling 2 million feet of timber in 1946 and 5 million in 1947. Production will increase as fast as construction will permit as demand and sawmill capacity is far in excess of supply. Due to lack of an improved road, no plans have been made for sale of timber from the northern area. Supply and mill capacity are indicated by the following pertinent information for the counties which are centered around and are the chief source of supply for the Anaconda Copper Mining Company's mill at Bonner which, it is estimated, processes approximately 95% of all sawlogs cut in this area.

ANNUAL MILLIONS OF BOARD FEET
AVERAGES FOR 1935 - 1940 INCLUSIVE

COUNTY	SAWLOG CUT	GROWTH
Missoula County	24.1	31.7
Powell County	24.3	11.2
Ravalli County	38.3	13.1
TOTAL	86.7*	56.0

* Does not include fire depletion.

It is thus shown that the local supply of timber is being exhausted at an alarming rate and exphasizes the necessity for harvesting on a continuous yield basis. Production during the war was far in excess of the above rate as shown by the following production figures for the Bonner mill.

ANNUAL PRODUCTION -- MILLIONS OF BOARD FEET

1944 -- 103.5	1937 -- 105.4
1943 -- 106.8	1936 -- 96.6
1942 -- 126.3	1935 -- 72.8
1941 -- 123.9	1934 -- 49.6
1940 -- 98.9	1933 -- 32.0
1939 -- 89.7	1932 -- 27.7
1938 -- 68.9	1929 -- 93.0

Average for 1935 - 1940 = 88.7

This indicates a total production for the area of 88.7/95 or about 93 million feet. This is somewhat in excess of the estimated sawlog cut of 86.7 million feet (log scale).

The maximum economical annual capacity of the Anaconda Copper Mining Company's mill is 106 to 112 million feet, which is practically double annual growth for the counties involved. Thus indicating that, even without considering existing small mills and the possibility of a few others being installed in the future, capacity of this mill alone is more than sufficient to handle total probable cut of timber, including the estimated volume to be brought in from Idaho.

By total cutting, it is estimated by the Anaconda Copper Mining Company that the Bonner mill can be operated only about 25 more years from privately owned timber. Which further emphasizes the need for opening up new areas, both public and private, in order to reduce the need for total cutting and to keep the mill in operation.

The Missoula County area tributary to Forest Highway No. 15 is favorably located, as much of the area nearer the Bonner mill has been depleted. However, it is the policy of the Forest Service, in order to encourage cutting on a continuous yield basis and to compensate for increased costs resulting therefrom, to reduce the stumpage price proportionatly. Unfavorably located areas receive the same consideration.

The foregoing discussion pertains to the southern end of the route only as it is contemplated that timber from the northern, or Lake County, end will be hauled north and be processed in Lake and Flathead Counties. Capacity of mills in these counties is far in excess of supply as shown by the following table.

ANNUAL MILLIONS OF BOARD FEET
AVERAGES FOR 1935 -- 1940 INCLUSIVE

COUNTY	SAWLOG CUT	MILL CAPACITY 16 Hrs. Per Day	ANNUAL GROWTH
Flathead Co.	79.5	375.0	41.0
Lake Co.	25.3	100.0	20.1
Total	104.8*	475.0	61.1

* Does not include fire depletion
* Estimated 1941-42-43 average = 140.0

It is thus indicated that rate of depletion in these counties is even greater than in the Missoula County area.

The Lake County area tributary to Forest Highway Route No. 15 is also favorably located as to distance from the sawmills which will process the timber and the above figures indicate the advisability of opening up new areas in these counties before areas now being worked are depleted to the point of exhaustion.

Attention should be called to the fact that conditions are probably worse than the figures indicate as a forest of mature age has very little increase in annual growth until it is thinned by cutting on a controlled basis. In addition, practically all harvesting to date has been on a total cut basis which practically eliminates these areas also from the annual growth estimate.

It is proposed to harvest the timber at the rate of approximately 200,000 FBM per day, 200 days per year, or 40,000,000 feet per year. One-half of this amount is to go to each mill, thus the traffic need be computed for one mill only or for 100,000 FBM per day. 85% of this amount is considered to be sawed lumber and 15% other products, pulpwood, poles, ties, etc. The daily harvest will then be 85,000 FBM sawlogs and 15,000 FBM other products.

LOGGING TRAFFIC

$\frac{85{,}000}{5{,}000 \text{ (average load with 8-foot bunks)}} = 17$ = Loads per day, or a traffic count of 34.

It is estimated that the average load of poles, posts, etc., will be about half that of sawlogs. Consequently, $\frac{15{,}000}{2{,}500}$ = 6 loads per day, or a traffic count of 12, or a total traffic count of 46

$\frac{85{,}000 \text{ (daily rate)}}{1{,}000 \text{ (employment factor)}} = 85$ = number of employees required in forest getting out sawlogs.

$\frac{15{,}000 \text{ (daily rate)}}{500 \text{ (employment factor)}} = 30 =$ number of employees in the forest getting out poles, posts, etc., or a total of 115 employees in the forest.

Due to the remoteness of the area from any community it seems reasonable to figure on logging camps. However, there are always some workers who maintain their own camps, consequently, it may be safe to assume that 25% of the employees will use private cars leaving 75% to use company busses.

115 x .75 = 86 = number of employees using bus transportation. (7 busses required)

7 x 2 = 14 = Traffic count for busses.

$\frac{115 - 86 \text{ (bus)} - 12 \text{ (truck drivers)}^*}{2 \text{ (car occupancy)}} = 9 =$ number of private cars and light trucks used by employees.

9 x 2 = 18 = traffic count for private cars and light trucks.

6 = estimated traffic count for light service trucks.

	DAILY TRAFFIC COUNT	NO. OF VEHICLES
Logging trucks (200 days).....	46	12
Passenger cars and light trucks- logging employees (200 days).....	18	9
Busses - logging employees (200 days)..	14	7
Light trucks - supplies, etc. (200 days)	6	3
Total.....	84 for 200 days	31

ADT for logging traffic = $\frac{84 \times 200}{365}$ or 46

It is not known just what areas will be logged first nor the exact plan of operation. However, as the timber lies on both sides of the proposed road for its entire length it is believed satisfactory to consider the ADT as uniform throughout.

Logging traffic for a maximum hour is difficult to estimate as it is conceivable that all vehicles might be proceeding to work within a certain

* 12 trucks 2 trips per day

morning hour. As previously estimated, 31 vehicles (including the 3 service trucks) will be involved in logging operations. If all these vehicles left camp during a certain hour in the morning enroute to work we would have the maximum hour for logging traffic. But a more reasonable expectation is that possibly 75% might leave within the hour, or 23 vehicles. This may be considered to be an actual maximum hour for logging traffic.

General traffic is very light in the morning when logging traffic is at a maximum. Consequently, a maximum hour for all traffic will be in the evening as traffic records indicate that heaviest general traffic is between 5 PM and 8 PM, or throughout the year approximately the hour preceeding sundown. As this hour coincides with the hour when logging traffic is most likely to be returning to camp we must add to maximum hour general traffic a percent of the logging traffic. The amount cannot, of course, be accurately determined but a reasonable estimate might be: 75% of the busses, plus one-half of the private cars, plus one-eighth of the logging trucks, and one service truck, or a total of 7 + 5 + 2 + 1, or 15 vehicles. As this traffic might be proceeding in the opposite direction from that of general traffic, it must be given full weight. Consequently, the maximum hour for all traffic will be 15 plus a maximum hour for general traffic determined as follows:

LOCAL AND THROUGH TRAFFIC

Traffic over the road at the present time is rather light due to the fact that there has been no construction to standard. However, due to the recreational importance of the road, summer traffic is expected to be quite heavy after construction is completed. In addition to the usual tourist traffic previously mentioned from surrounding communities and from throughout the State, it is believed that there will be a certain amount of traffic that will make the round-trip-Missoula, Polson, Bigfork, Swan Lake,

Seeley Lake, Federal-aid Junction 24 and back to Missoula after the highway is completed. The distance involved constitutes a leisurly one-day drive and circular trips of this kind are particularly attractive to many holiday pleasure seekers and Missoula, one of the largest cities in Montana west of the Continental Divide, should generate considerable traffic of this character. Consequently, it is believed that on the strength of the heavy recreational traffic likely to be developed, it would be reasonable to double 1941 traffic and increase this amount by the usual secular factor of 1.3 to raise it to 1960. Estimated traffic will then be as follows:

	1941	1960
Bigfork.....	140	364
Swan Lake.....	25	65
Summit.....	45	117
Seeley Lake.....	55	143
Junction FA Route 24.	95	247

Average maximum summer traffic will be double these figures or 728, 130, 234, 286, and 494 respectively, and a maximum hour for the three points on the Forest Highway Section would be 13, 23, and 29. If the previously determined maximum hour of 15 for logging traffic is added we have maximum hours of 28, 38, and 44 over the Forest Highway Section. For design purposes it is believed the larger of the three figures, or 44, should be used, as the other two reflect the primitive condition of the present road between Seeley Lake and Swan Lake.

Although traffic usually decreases towards the center of routes of this character, the minimum hourly figure of 28 would still fall in the same category as the maximum figure of 44. That is, it is usual practice to apply the 50 vehicles per hour category to all projects carrying from 20 to 50 vehicles per hour.

It has already been determined that logging traffic will be more or less spread over the entire route and that there will be considerable through recreational traffic, which adds support to the opinion that the larger figure of 44 should be used throughout the route for design purposes. Further support exists in the form of the general location of the route and lack of restricting canyons and perceptible summits. Thus there are no physical obstructions to restrict traffic to the ends of the route or to act as deterents to through traffic. Recreational possibilities are approximately the same throughout the length of the route also.

CONSTRUCTION COST

Construction costs will be moderate as no canyons are encountered and side slopes are comparitively flat, and as previously stated, grades will be very light. Clearing can be classed as medium as the forest is not very dense and the trees are not exceptionally large. No large streams are crossed consequently cost of drainage structures should be moderate.

On account of these factors, all favorable from a construction standpoint, the District Office estimates that average cost will be approximately 25,000 dollars per mile, or a total of $1,725,000 for the 69 miles involved.

The Forest Service considers that a reasonable charge against stumpage for main road construction is $1.00 per thousand FMB and as there is only an estimated 1½ billion feet of lumber tributary to the highway, it would appear that construction of this route is not quite economically sound on this basis. However, this method of determining solvency does not attempt to predict when the funds will become available nor take into consideration interest and maintenance costs. Also it is self-evident that timber produces no income while it remains standing in the forest.

Another approach to the solvency of the project is obtained by considering annual forest income as follows:

The Forest Service offers the following information:

> Value of stumpage to the public before any road is constructed = $0.00 per M.F.B.M.
>
> Value after construction = up to $7.50 per M.F.B.M. $5.00 would be a conservative average figure to use as the increase due to construction of roads. One-half of this should be allocated to construction of main roads and one-half to feeder roads and Forest administration.

Using the above criteria we have an income of $2.50 x 40,000 M.F.B.M. (expected annual production) or $100,000. $\frac{100,000}{69}$ = $1,450 income per mile. Plus 46 + 143 (ADT for logging & general traffic) x $1.50 (average annual estimated income per vehicle per mile from gasoline taxes) = $284. $284 + $1,450 = $1,734 total annual income per mile.

Estimated construction cost per mile = $25,000

Interest at 2½% for 25 yr. ÷ 2 = 7,812

$32,812 cost per mile

$\frac{32,812}{25}$ = $1,310 annual cost, + $300 maintenance = $1,610 total cost per year compared to annual income of $1,734. If this method of justification were accepted construction of the highway appears to be economically sound. However, it should be remembered that all these estimates are based on proposed plans of operation which, if not carried out, will nullify all our estimates. The report stated in the beginning that we would not attempt to justify construction from a financial standpoint. However, the preceding cost analysis indicates that, if indirect returns and financial income are both taken into consideration, the project becomes solvent. It should be noted though that actual cash income from traffic is just about sufficient

to pay for maintenance, leaving the entire construction cost to be charged against indirect income resulting from the increased value of the timber.

SUMMARY

Pertinent information and data, herein assembled, are summarized as follows:

1. Construction of the route is of importance to 4 classes of traffic, namely:

   Recreational
   Logging
   Forest Administration
   General or Local

2. The route is of primary importance to the logging industry and to recreational traffic.

3. It is the only through highway serving the Swan and Seeley Valleys.

4. It is not on any other Federal or State System, except for a few miles at each end.

5. Average daily traffic in 1960 is estimated to be 189 vehicles, including logging traffic.

6. Grades will be exceptionally light - only sufficient for drainage purposes and to accomodate lightly rolling topography in certain places.

7. No major streams are crossed, thus cost of structures will be moderate.

8. It is proposed to harvest the timber tributary to the route at the rate of approximately 40 million FBM per year.

9. Cost of construction is estimated to be $25,000 per mile including bituminous surfacing, or a total of $1,725,000.

10. Construction may be considered to be economically justified if all direct income, and indirect income of $2.50 per M.B.M., are credited to main road construction. (See page 13).

Montana Forest Highway Route No. 15 has been given a tentative priority rating of 26 by the District Office. That is, by the method employed, there are 25 other Forest Highway Routes in the State that justify constructing or improving before Route No. 15. Each route was rated by giving consideration to the following items:

1. Estimated 1960 traffic.
2. Deficiency in existing roadbed and standards.
3. Estimated cost.
4. Potential timber production.
5. Estimated 1960 truck traffic.
6. Recreational importance.
7. Dustless surfacing deficiency.
8. Military importance of the road.

This method of rating should result in a reasonably reliable priority being established for each route, the accuracy of the result depending only on the proper value being assigned to each item for each of the routes on the system.

However, attention is called to the fact that these District Office ratings include all classes of Forest Highways, that is, classes 1, 2, and 3. Thus, class 2 and 3 roads are competing with Class 1 roads. Class 1 roads must be on Federal-aid routes or extensions thereof and consequently constitute the main traffic arteries of the State, while Class 2 and 3 routes are primarily for Forest Administration, and for development of timber resources and recreational attractions. Consequently, it seems that it would be more reasonable to separate the ratings into two groups, one for Class 1 routes and the other for Class 2 and 3 routes.

It is noted that all 25 routes that rate ahead of the Swan River road are Class 1 routes with the exception of two, and these two are prospective Class 1 routes. Of the remaining routes only one is class 1 and it rates No. 30. Consequently, the Swan River route would rate No. 1 in a list composed of strictly Class 2 and 3 routes, although in the total list it now rates No. 26. Even in this latter list it carries a rating of 1 in recreational importance and stands No. 3 in potential timber production.

It is thus indicated that the Swan River route is of importance even though it has not been previously programmed for construction. However, this lack of programming is explained by the fact that no funds have been available previously for this class of roads as Forest Highway appropriations have always been insufficient to take care of required work on the Primary System, thus making it impossible to construct secondary roads such as the Swan River route, regardless of how deserving they might be. It might be considered that need for construction of this route is a borderline case from an economic point of view when considered with all Forest Highway Routes on the System; but, when considered with Class 2 and 3 routes only, or from the standpoint of potential timber production and recreational possibilities, the route becomes of considerably more importance.

RECOMMENDATIONS

Before deciding on standards to be used for construction it might be well to briefly discuss highway widths in general as recommended by the A.A.S.H.O. and as shown in the attached "Design Category" tabulation, revised for Forest Highway Projects.

Widths are controlled primarily by volume of traffic and to a lesser extent by speed. In the early days of the automobile, traffic was light and speeds were slow, consequently narrow widths were reasonably satisfactory.

However, traffic and speeds increased faster than construction advanced, thus on the average leaving the majority of highways too narrow, and of course unsafe. It is more or less accepted that there are only four widths of pavement to be considered for two-lane highways, 18, 20, 22, and 24 feet.

As a help in deciding which of the four widths should be selected in any specific case the following information should be considered:

SIGNIFICANT CONCLUSIONS (Excerpts)
Resulting From
SPECIAL STUDIES MADE BY THE
PUBLIC ROADS ADMINISTRATION
(Public Roads Vol. 24 No. 6, Dec. 1945)

1. "Hazardous traffic conditions exist on pavements less than 22 feet wide that carry even moderate volumes of mixed traffic. On 18-foot pavements with grass or gravel shoulders, 11 percent of the drivers of trucks and 5 percent of the drivers of passenger cars fail to keep their vehicles within their proper traffic lane even when meeting oncoming traffic.

2. "Shoulder use increases rapidly with a decrease in pavement width below 22 feet. An insignificant number of moving vehicles use the shoulders on pavements of that width. On 18-foot pavements with grass or gravel shoulders, however, 5 percent of the commercial vehicles use the shoulder as they meet oncoming traffic. The corresponding value is 17 percent on highways with bituminous shoulders.

3. "Bituminous-treated shoulders, 4 feet or more in width, adjacent to 18 and 20 foot pavements, increase the effective surface width approximately 2 feet.

4. "Shoulder width in excess of 4 feet does not influence the effective pavement width for moving vehicles when there are no vertical obstructions immediately adjacent to the shoulders. This must not be interpreted that shoulders wider than 4 feet are not necessary for other important reasons.

5. "When a passenger car meets a commercial vehicle on a pavement 22 feet wide, the passenger car has the desired center and edge clearances but the commercial vehicle does not. To permit clearances for commercial vehicles a 24 foot pavement is required."

It would appear, then, that a 24 foot width is satisfactory for a two-lane highway, and an 18 foot width is hazardous, especially in mountainous country, due to the tendency of cars to run off the pavement when passing other vehicles, and to lack of center clearance.

On the other hand, an insignificant number of vehicles run off the pavement when the width is 22 feet, and center clearance of passing vehicles is satisfactory except for some commercial vehicles.

It is also indicated that a 24 foot width is not justified unless traffic is fairly heavy, and that for low or medium traffic satisfactory widths can be obtained by adding bituminous shoulders to the 20 and 22 foot widths, thus increasing effective width to 22 and 24 feet respectively.

Evidently the 18 foot width should be ruled out entirely except in extreme cases where traffic is very low and at the same time the terrain is exceptionally heavy and economy requirements dictate a temporary width of 18 feet.

The majority of logs to be hauled over the Swan River Road will be 32 feet in length with a maximum of 40, consequently, it is believed any width of roadbed satisfactory for general traffic can be considered satisfactory for logging traffic also as the legal length of freighting combinations in Montana is 60 feet. For this route, then, we have but two widths to consider, 20 and 22 feet, as the 18 and 24 foot widths are ruled out -- the one because it has been shown that 18 feet is too narrow under ordinary conditions, and the other one, or 24 feet, by the fact that it is not justified by the estimated traffic volume.

The estimated maximum hour of 44 vehicles indicates that a 20 foot width with four foot treated shoulders should be satisfactory as moderate speeds are expected due to the fact that a high percentage of the traffic will be recreational. A 50-P-40 Design Category is therefore indicated and recommended.

No large streams are crossed so no long structures will be required, consequently the question of vertical clearance for logging traffic will not be involved. However, as a considerable percentage of the traffic will consist of heavy loads of logs, particular attention should be given to the carrying capacity of all structures. Standard super elevations should be satisfactory as curvature and grades will be light.

The amount and character of traffic will justify bituminous surfacing and a base of sufficient thickness to carry exceptionally heavy loads of logs must be provided.

Amount of traffic, recreational importance, importance to the logging industry and to forest administration, and local necessity, all emphasize the importance of the highway and support the recommendation that it be constructed in accordance with the above recommendations if and when funds become available.

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FEDERAL WORKS AGENCY
PUBLIC ROADS ADMINISTRATION
DIVISION No 8

DESIGN CATEGORY
FOREST HIGHWAYS
(12-28-37) Revised 4-7-45

1	2	3		4	5	6	7
CLASSIFICATION	MIN.WIDTH OF PAVEMENT	TOP SHOULDER WIDTH ADDL. MIN.	DESIRABLE	MAX. DEGREE CURVE	MAX. GRADE	MIN.NON-PASSING SIGHT DISTANCE HORIZ.& VERT.	MIN SAFE PASSING S.DIST
20 P 30	18	3	4	24	6	200	500
50 P 30	20	3	4	24	6	200	500
100 P 30	22	4	8	24	6	200	500
200 P 30	22	4	8	24	6	200	500
20 P 40	18	3	4	14	6	275	900
50 P 40	20	3	4	14	6	275	900
100 P 40	22	4	8	14	6	275	900
200 P 40	22	4	8	14	6	275	900
300 P 40	22	4	10	14	6	275	900
20 P 50	20	3	4	9	6	350	1400
50 P 50	22	3	4	9	6	350	1400
100 P 50	22	4	8	9	6	350	1400
200 P 50	22	4	8	9	6	350	1400
300 P 50	22	4	10	9	6	350	1400
20 P 60	20	3	4	6	6	475	2100
50 P 60	22	3	4	6	6	475	2100
100 P 60	22	4	8	6	6	475	2100
200 P 60	22	4	8	6	6	475	2100
300 P 60	22	4	10	6	6	475	2100
50 P 70	22	3	4	4	6	600	2900
100 P 70	22	4	8	4	6	600	2900
200 P 70	22	4	8	4	6	600	2900
300 P 70	24	4	10	4	6	600	2900

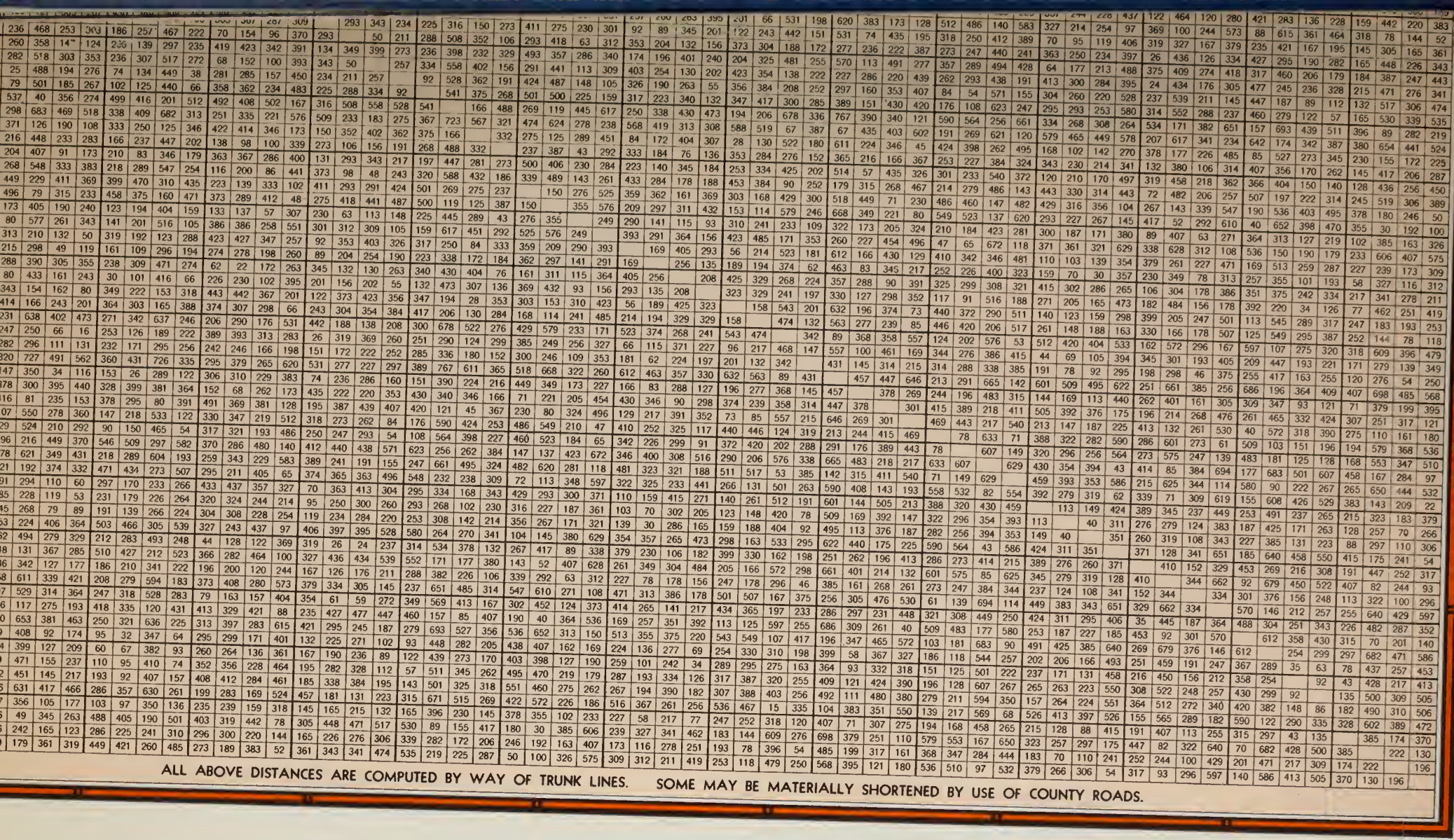
Notes:

(a) The Minimum Non-Passing (safe stopping) Sight Distance is based on the distance along a line of sight measured from the eye of a driver 4.5 feet above the pavement to the top of an object 4 inches high. Safe passing distance is measured 4.5 feet to 4.5 feet.

(b) 20P30 means 20 vehicles, predominantly passenger type, in an average summer maximum hourly period traveling at a design speed of 30 miles per hour.

(c) Add 4' extra width on inside of 24° curves and 2' extra width on 14° curves.


OUTLINE OF TRIBUTARY
TIMBER AREA
FOREST HIGHWAY ROUTE NO. 15
GLACIER
NAT'L
PARK
INTERNATIONAL
PEACE
PARK
FLATHEAD
NATIONAL
FOREST
Whitefish
Kalispell
Columbia Falls
Polson
Ronan
Missoula
Helena
Great Falls
Anaconda
Butte
Deer Lodge
Philipsburg
Hamilton
Browning
Cut Bank
Shelby
Conrad
Choteau
Augusta
Valier
Dupuyer
Bigfork
Somers
Creston
Swan Lake
Seeley Lake
Ovando
Lincoln
Bonner
Clinton
Drummond
Avon
Elliston
Stevensville
Corvallis
Darby
Warmsprings
Boulder
Townsend
Whitehall
Sula
LOLO
NATIONAL
FOREST
LEWIS
AND
CLARK
TETON
TOOLE
PONDERA
MISSOULA
GRANITE
POWELL
LAKE
BROADWATER
JEFFERSON
DEER LODGE
SILVER BOW
RAVALLI
BITTERROOT
BEAVERHEAD
DEERLODGE
HELENA
BLACKFEET
INDIAN
RESERVATION
FLATHEAD
INDIAN
RESERVATION
MONT.



ALL ABOVE DISTANCES ARE COMPUTED BY WAY OF TRUNK LINES. SOME MAY BE MATERIALLY SHORTENED BY USE OF COUNTY ROADS.

...me to the Land of the Shining Mountains"

...your stay within our borders to be so ... that you will return many times. Our ... recreation are unlimited; our scenery ...our topography is varied and the ...pitality of our people are unfailing.

...e third largest state in the Union. It is

motorists will suffer the minimum inconvenience. Every man associated with this department is instructed to render every courtesy and assistance to our guests.

The foregoing is in no sense an apology for our highways. We are proud of the progress made during

MONTANA

The Alluring and Soul-Satisfying

ON the note that "Travel Strengthens America," Montana, the Treasure State, lifts her song of invitation to the tourist who may be planning a "See America First" trip for 1942. In these trying times most people are living on a sort of forced draught program, and it is known of all men that this cannot be maintained indefinitely without danger of failure of some part of the delicate human mechanism.